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THE ONTARIO POWER COMMISSION: ITS ORIGIN AND DEVELOPMENT

With scarcely a notice from the press and but little attention from public men, except those concerned in preparing the legislation, there was passed in Congress, in June, 1920, an act which is bound to have a great and growing influence in the general industrial development of the United States and in the extent to which the states and their various municipalities will accept the opportunities offered of controlling their own public services. This act creates what is known as the Federal Power Commission. By a stroke of common-sense statesmanship the departmental conflicts that have hampered the free development of the great water powers of the United States for nearly a century are ended.

Hitherto three departments—War, Interior, and Agriculture—have exercised authority in matters affecting the rights and privileges of those who would develop water powers. Since the long-distance transmission of electricity by hydraulic energy has come to play such an important part in industry and transportation many an enterprise of public value has been halted by a question of interference with navigation, or a question of land damage or some other question that was not to be settled by reference to one of these three departments alone. No longer will applicants for power rights be buffeted between the Scylla and Charybdis of discordant views of the different departments having jurisdiction over water and power problems, for the new Federal Power Commission is composed of the Secretary of War, the Secretary of the Interior, and the Secretary of Agriculture, and on all questions relating to the use of water for power they will not only act as a court of inquiry, but their discussions will be a voice of authority and an assurance of safety to all who are willing to study the public interest in carrying on a public service.

The act applies to water powers of over 100 horse-power, and licenses to utilize power are granted for a period not exceeding

50 years. Among the applicants for licenses, preference is given to states or municipalities, but as between private applicants preference is given to those whose plans are best adapted to use the water in the public interests, for navigation, for power and conservation purposes. One noteworthy provision is that licenses for the development and transmission by states or municipalities shall be enjoyed without charge to the extent that such power is sold to the public without profit. The regulations in force in states which have public service commissions are to be observed by the licensees of power, but where a state has no such commission the regulations and conditions made by the Federal Power Commission shall prevail. An applicant for power privileges must file plans of the proposed work; records of costs of construction are to be kept and at the end of 20 years reserves are to be held at the disposal of the Commission for the amortization of development and distribution costs.

Upon this foundation there should be a rate of progress in water-power development beyond any degree of the recorded past. The greatness of this newly opened door will be seen when it is stated that of all the resources of primary power in use in the United States according to the latest special reports¹ steam, up to 1912, still constituted 80 per cent of the total, and water power only 16 per cent; yet in the period from 1902 to 1912 the use of water power increased 137 per cent whereas the use of the steam increased only 96 per cent. The large aggregate of steam-raised power is due to the fact that in those regions—as for example, the New England States—where population is greatest and industries longest established, water powers are relatively smallest and coal cheapest. But that the day of hydro-electric development is now dawning is shown by the fact that in the group of eleven states which include the Mountain States and Pacific Slope States—where coal is dear and water power most abundant—water-power development increased 451 per cent in the period from 1902 to 1912 and the installed water power per capita of population was also over four times that of the rest of the states. The

¹ "Electric Power Development in the United States," Report to Senate by the Secretary of Agriculture, 1916.

future in store for hydro-electric energy is disclosed in the estimates of the potential water-power resources of the United States. These estimates vary from 20,000,000 to 200,000,000 horse-power, but accurate knowledge is not yet available and it is safest to take the conservative estimates of the Geological Survey which, at a "plant efficiency" of 75 per cent, indicate 27,943,000 horse-power at the minimum of stream flow for the average year, or 53,905,000 horse-power calculated on the maximum flow of the streams. The Commissioner of Corporations in his report estimates the minimum total at 32,083,000 horse-power and the maximum at 61,678,000 horse-power. Of this vast potential natural resource less than 5,000,000 horse-power had actually been harnessed for use in 1912. Taking the developed total at one-sixth of the potential power—say 30,000,000 horse-power—it would mean that if the water-power resources of the United States were today in full service a coal bill of \$1,200,000,000 a year at present average prices would be saved. Returns made to the Interstate Commerce Commission show that the electrification of the steam railways would, of itself, reduce the coal consumption for railways alone by 80,000,000 tons a year, an amount equal to one-sixth of the coal produced for all purposes in the United States. This saving would be effected, even if steam were still largely used to generate the power in central stations for locomotive purposes.

The increase in the price of coal during the past twenty years seems destined to be permanent, if the mines are not expropriated in the common interest, and this prospect enforces the need of a more comprehensive development of hydro-electric power. It is tolerably certain, therefore, that under the aegis of the new Federal Power Commission various states, including many urban municipalities, will desire to create new water powers on a scale which has not heretofore been attempted by private individuals or commercial corporations. No more enlightening example can be given of the possible attainments in this field than is presented by the evolution of the Hydro-electric Power Commission of Ontario.

Beginning operations in 1910 as a distributor in the Niagara district of only 750 horse-power, none of which it generated, the

Hydro-electric Power Commission of Ontario has grown to be the largest generator as well as the largest distributor of electric current in the world, its systems of generating stations now covering an area extending from the valley of the Ottawa on the east to the Detroit River on the west, and from the shores of Lake Erie and Lake Ontario on the south to the sparsely settled region north of Lake Superior. When the extensions now under construction are completed, as is expected within the next two or three years, the twelve systems in operation under the commission will have an aggregate of 1,400,000 horse-power. This does not take into account the power incidental to the Saint Lawrence canal improvements or the Georgian Bay canal developments, the former of which, if carried out, would add one to two million horse-power each to the province of Ontario and the state of New York according to the plan of water storage and power development, while the Georgian Bay scheme would yield a million horse-power—a sum sufficient to pay the cost of the navigation improvement. By virtue of its achievements the Commission has become recognized as a unique adventure in economic legislation as well as in its plan of administration.

The natural wonder of Niagara Falls, which has attracted sight-seers from all over the world ever since it was described by Father Hennepin in 1698, would of course become the first study of electrical engineers when the feasibility of transmitting power to distances from the immediate site of its production was demonstrated. The creation of the state parks on each side of Niagara Falls had a bearing on these developments. When Lord Dufferin, while governor-general of Canada, visited the Falls in 1878 his sense of the artistic was shocked by the horde of fakers, touters and cabmen who, with methods approaching that of the bandit took merciless toll from the tourists at every point of vantage. He proposed to the governor of New York that a state park be established for the double purpose of beautifying the surroundings of the Falls and of protecting the people in their right to a free and peaceable view of the great waterfall. Lord Dufferin's idea was that these should be national parks and the Ontario government gave up its local rights in favor of the Dominion government.

The federal government failed to act and, after five years, the Ontario government took up the obligation and at a cost of \$525,000 created the Queen Victoria Niagara Falls Park, prohibited gambling, the sale of intoxicants and soliciting by cabmen and others within the reservation. Corresponding action was taken by the state government on the New York side. On the Ontario side, however, the revenues from such concessions as might be maintained in the public interest were quite insufficient; and the Park Commission into whose hands the management of the park was committed turned to the idea of the lease of power rights as a means of revenue which might be obtained without a direct tax on the province. "Thus by the advance of electrical science the field of exploitation at Niagara Falls was suddenly enlarged from the ten-cent faker in natural scenery to the ten-million dollar concessionnaire who was to take toll of the powers of nature." The result of this system of power leases is that the Park Commissioners now derive a revenue of about \$300,000 a year and have enlarged the original reservation of 154 acres to a park which within a few months will comprise 1,550 acres, extending above the river from Lake Erie down to Lake Ontario, and including several historic sites and monuments.

Broadly speaking it may be said that the transmission of electric current to any distance beyond a dozen miles did not become of practical interest to engineers and industrial corporations till the very close of the nineteenth century; yet before the twentieth century opened a score of companies were on the lookout for power privileges at Niagara Falls and along the Niagara River. On the New York side a water-power company had been incorporated in 1853, and it lighted the business streets of Niagara Falls as early as 1881. Perhaps the first practical plant used in conveying power as well as light was installed by the late John R. Barber at his paper mill at Georgetown, Ontario, in 1888; but the first long-distance line of note in the United States was put in operation at Pomona, California, in 1891. The first lease of power on the Canadian side granted by the park commissioners was made to the Niagara Falls Park and River Railway at a rental of \$10,000 a year; but the condition of electrical science at this date is

indicated by the fact that the dynamo of 200 horse-power for the operation of this line installed in 1900 was the largest that had been built in Canada.

The tremendous extension in the range of electrical transmission within the space of a few years may be measured by two facts: one is that the power of dynamos has increased from the 200 horse-power mentioned to those that are now being made for the Hydro-electric Power Commission having 52,500 horse-power each; the other is that pressures have increased from a thousand volts or so to the 110,000 volts now attained in the regular operations of the same commission from their Niagara plants, which are able to transmit current 250 miles as far west as the Detroit River. So great was the faith of engineers and financial men in the future of electric power and the industrial creations therefrom that three power companies on the Canadian side (to which side seven-eighths of the volume of the Niagara flows at the cataract) and one on the American side were energetically at work on power plants capable of generating over 400,000 horse-power when as yet they had not an actual market for 50,000 horse-power. It was under these circumstances that the generating company on the American side, having acquired large blocks of land, was anxious to turn these blocks of land and power into blocks of revenue, and so it came about that favorable and permanent rates (from \$14 to \$18 per horse-power per year) were given to companies prepared to start electro-chemical, and electro-metallurgical industries whose commercial success depended upon the command of power cheaper than could be obtained from coal, with the control of temperatures that could be attained only through the electric furnace. The result was of national significance beyond the conceptions of the power projectors, for at this day more than thirty of the industries of the city of Niagara Falls—which has grown from a population of 10,000 in 1892 to 60,000—are the direct offspring of the cheap electric power, while the establishments using the materials from these as by-products number over two hundred. So important had these products become that when the United States entered the European war the government found it necessary to take control of the whole chemical and power output of 278,000 horse-

power for the manufacture of war chemicals, placing federal guards over the works.

It was not so on the Canadian side, where, apart from the considerable blocks of power delivered to Buffalo and other New York points before the further export of power was prohibited, it was the evident policy of the private power companies to sell at the highest rates obtainable without spending time and money in founding electro-chemical and electro-metallurgical industries. At this period there was every prospect of the establishment of a monopoly of electric power covering Toronto and every other important city and town in western Ontario. In Toronto there was a company which already controlled the power and lighting business of the city under a charter which the holders construed virtually perpetual; there was another company which owned the city street-car service and there were three other companies which together monopolized the suburban electric railway traffic leading into the city from the east, west, and north. All these corporations were controlled by the same group of capitalists. At an early stage of hydro-electric development one of the three companies on the Canadian side at Niagara was preparing especially to control the power supply of Toronto and other places, and was actually the first to deliver current in that city. Now this corporation had a board of directors interlocking with the directorates of the group of transportation and power interests referred to. The generating company did not transmit its own power, but created a separate company for transmission purposes, and the system was correlated by a holding company, the entire series being directed by these interlocking directorates. So far as the generation and distribution of Niagara power was concerned the system provided four stages of profit between the point of development and the areas of consumption by the people; and thus the foundations were laid for an incalculable amount of tribute to be paid by the people beyond the cost of the power and service of distribution. A similar situation existed in Hamilton, whose electric lighting and power services were monopolized by a company generating power at DeCew's Falls, thirty-five miles distant, and drawing its water from the Willard Canal at a point twelve

miles west of Niagara Falls. The Hamilton company was actually the pioneer of the large generating companies and made such profits that in the course of a few years it was able to obtain control of the lighting and power business, not only of Hamilton, Brantford and several neighboring towns, but of the street railway systems of Hamilton and Brantford and of the electric lines radiating from Hamilton. Fourteen corporations were thus brought under one control by interlocking directorates. It was alleged that with the great head of water obtainable at DeCew's Falls—265 feet, or nearly double that of one of the Niagara plants—the Hamilton company could generate at a profit at \$4.50 per horsepower per year in the early years, and yet it was charging the city \$84 per year for each arc lamp, while commercial users of current were charged 15c per kilowatt hour. In Toronto, Montreal, Ottawa, and other cities, at this period there were no standard or uniform rates for power or light, but each applicant was judged as to his ability to pay or as to the urgency of his business needs, and charged accordingly.

Alarmed at the exactions in prospect from these power monopolies the governing bodies of municipalities began to meet to investigate the power problem, and many influential newspapers advocated the purchase and distribution of current direct by municipalities. Informal conferences by representatives from city councils were held, and a fund was raised to defray the cost of an inquiry by a firm of electrical engineers. Meantime protests were made at the freedom with which the provincial government permitted valuable power concessions, not to speak of mineral rights and timber limits, to be handed out to concessionnaires who were placed in position to acquire huge profits at the public cost. The franchise holders were intensely unpopular, and the government which favored them shared this unpopularity to such an extent that it was defeated in the election of 1905. Yielding to pressure of public opinion, exerted through a large deputation from the municipalities, the government, before its fall, passed an act enabling a group of municipalities, acting under a board of commissioners, to acquire works for generating and distributing electricity, the cost to be defrayed by the bonds of the co-operating bodies,

after authorization by the electors of the municipalities concerned.

The leader of the opposition party in the legislature, Sir James Whitney, had been an outspoken opponent of the private monopoly of hydro-electric power, and on the change of government he became premier. One of his first acts on coming into power was to cancel a provisional agreement, made by the late government, but not yet executed, making over another block of 125,000 horse-power to one of the Niagara development companies. Sir James abandoned the first power act and then passed in 1905 an act which became the charter of the Hydro-electric Power Commission of Ontario. A provincial commission of inquiry had been authorized in addition to the unofficial one referred to and the two reports were given to the public within a few days of each other in March, 1906. There were no statistics available then as to the market for power, and calculation had to be made upon a personal canvass of the manufacturers and business men in the areas most interested. In the seven municipalities that had undertaken to become the pioneers of the co-operative movement for power—namely, Toronto, London, Brantford, Stratford, Woodstock, Ingersoll and Guelph—it was estimated by one of the commissions that about 55,000 horse-power would be used by this group at the start, and this might be increased to nearly 90,000 horse-power in two years. The price was calculated at \$7 or \$8 per horse-power at the Falls or \$14 to \$15 per horse-power delivered to the various towns concerned, the most distant of which was about 125 miles from Niagara.

These cities and towns having voted to enter the movement, the commission, not desiring to impose too great a burden on its constituent municipalities, decided not to construct its own power plant at Niagara, but made a contract with the Ontario Power Company, one of the three Canadian companies, by which the Commission might take its whole output at a price which would be definitely but not extravagantly profitable. By this agreement the price to the commission was to be \$9.40 per year for amounts up to 25,000 horse-power and \$9 when the total exceeded that amount of power. The agreement was to extend by ten-year periods to 1950, the commission having the right to expropriate

the plant, which was afterward done. This arrangement saved the commission the loss of four years' time, which would have been required if it had built its own generating plant, and from the side of the Ontario Power Company it gave them a customer which was likely to use the company's entire output, making it unnecessary to hunt for small power users. It may be here stated that during the first year of this new contract the commission reduced the costs of operation of the plant by over \$40,000, and the revenues from a contract with local interests and with the Niagara-Lockport Company of New York, to which the Ontario Company was exporting 60,000 horse-power, will be sufficient to retire the whole of the debt involved in the purchase in 25 years, instead of 40 years, as provided in the bonds. Subsequent development disclosed another public advantage in this purchase. There is now under construction by the commission a new generating station, known as the Queenston-Chippawa development, by which a head of 305 feet will be obtained, or about double the average head of the existing power houses on the Ontario side. As the power obtained is in proportion to the extent of the drop, it follows that if the whole of the 36,000 cubic feet per second permitted to Canada under the present international treaty were utilized at the new site, the result would be 30 horse-power per cubic foot per second or over 1,080,000 horse-power instead of about 400,000 horse-power now produced by all the private corporations on the Canadian side. The new Queenston-Chippawa development will have an initial capacity of about 300,000 horse-power and the Ontario Power Company plant a capacity of 180,000 horse-power. If there is to be no further diversion of the waters of Niagara it would therefore, ultimately, be profitable to scrap the Ontario plant and divert all the water to the Queenston site.

While the private power kings were seeking to turn the Niagara River into a colossal generating station various societies and many influential individuals protested to both the Canadian and United States governments against the destruction of Niagara Falls as a natural wonder. These aligned themselves with the civic bodies and the industrial interests who wished to obtain power direct for their common needs without the oppressive surtaxes of private

profits then exacted. The question was referred to the International Waterways Commission, appointed by Great Britain (acting for Canada) and the United States. At first this commission considered it chiefly as a problem of navigation, but when, in 1909, the treaty known as the International Boundary Waters Treaty was ratified, three considerations stood before all others, in the order of their statement as follows: (1) the uses of the water for domestic or sanitary purposes; (2) uses for navigation, including water service for navigable canals; (3) uses for power and irrigation purposes.

These considerations are noteworthy in that they do not recognize the claims of those who would preserve the falls as a spectacle of nature. The International Joint Commission, to whom the further consideration of international waterways was committed, is now considering the navigation and power improvements of the St. Lawrence River and will naturally reconsider the Niagara River situation. Recognizing the growing public demands for cheaper hydro-electric power, it seems fairly certain that further diversions of water for power purposes, the public rights being safeguarded, will be permitted at an early date, as they may be without materially damaging the scenic grandeur of the falls. Indeed the day seems not far distant when the whole fall of the Niagara River, estimated at 6,000,000 or more horse-power according to the plan of developing, will be transformed into a vast gallery of hydro-electric generating stations, so pressing are the public needs for producing a cheaper power than that from coal.

At present the diversion of water on the American side is approximately 20,000 cubic feet per second, the apparent difference in favor of Canada at Niagara arising from the fact of the diversions of water at Chicago for the drainage canal, which diversions, by the way, do not solve the problem of sanitation of that city, and are comparatively a waste of water if used for power purposes under the low heads obtainable.

When the official provincial power commission was organized the new premier chose as its chairman Mr. Adam (now Sir Adam) Beck, who was invited to be a member of the cabinet for the purpose of working out a power policy for the whole province. Sir Adam

Beck had had municipal experience as mayor of London, and was himself a large manufacturer in that city. Sir James Whitney's judgment in selecting him was amply justified in the results. For twelve years he gave his abounding energies and unconquerable courage to the work without salary. All his devotion, all his constancy of purpose were needed, for no man and no organization ever encountered a combination of financial and industrial interests more thoroughly entrenched in their hold on civic functions or more intimately dovetailed with local influences than did his commission in these early crucial years. The new commission appointed a staff of engineers to make a general survey of the water-power possibilities of the whole of the settled areas of the province, and within a few months reports were presented dealing with five main regions. The first dealt with the region from Niagara Falls west to the Detroit River and north to Toronto; the second report with the water sheds of the Trent and Moira rivers to the north of Lake Ontario; the third, with the counties whose rivers flowed into Lake Huron and Georgian Bay; the fourth covered the region lying between the St. Lawrence and lower Ottawa rivers; and the fifth considered in a general way the great water powers of the region, still scarcely colonized, to the north and east of Lake Superior. These reports revealed the fact, as yet not realized, that Ontario contained not one, but many potential Niagaras, and they appeared at a time when the exorbitant profits made by the private power and lighting companies enforced the conviction that these great water-power resources, capable of influencing living conditions at distances of over 200 miles from the seat of generation, should be controlled in the public interest.

The basic principle on which the operations of the commission began and to which it has consistently adhered all along has been the supply of power to its constituent municipalities at a price which would cover the cost of the transmission lines and the cost of operation and maintenance without taking to itself any direct profits out of operation, and consequently without attempting to capitalize such profits into a vested right or a form of good-will.

The act creating the Hydro-electric Power Commission of Ontario has been amended from year to year as circumstances required. Without tracing these amendments a general sketch of the plan of operation will be sufficient. The Commission is composed of three members, one of whom shall be, and two of whom may be, members of the provincial cabinet. Two members form a quorum; the commissioners hold office during the pleasure of the government, and vacancies are filled by the Lieutenant Governor-in-Council or, in other words, by the administration of the day. Power is conferred on the Commission to appoint its own engineers, executive officers and staff, and to fix their salaries, subject to ratification by the government. Happily the governments have not interfered in these appointments, and the Commission, in being at liberty to seek the best talent available, has avoided the weakness of national and state civil services which permit themselves to be too largely the dumping ground of the incapables of the country.

The Commission may report on any lands, waters, or water powers, including any generating plant, which it is desirable to acquire, and upon authorization by the Lieutenant Governor-in-Council, may buy or lease such property; or may contract with any private person or company for the supply of electric energy; but in case of acquiring a railway any net profit under such contract shall be applied to the general work of the commission. The Lieutenant Governor-in-Council may raise by loan on the credit of the province any sums needed by the Commission, such sums to be accounted for by the Commission and audited the same as other public accounts, and the receipts by the Commission are to be paid over to the Provincial Treasurer in order to retire the securities issued. The Commission has its own financial officer, called the Comptroller, who supervises the financial transactions of the Commission and the municipalities and fulfils duties corresponding to those of the provincial treasurer; even to the preparation of the "budget" or estimates for the ensuing year. The Commission's lands are liable to school taxes and municipal taxes, but its buildings are exempt. No member or officer of the Commission may be financially interested in any way in any company

engaged in the electrical power or transmission business, or dealing in any electrical apparatus or process.

The Commission has the right of "eminent domain," that is of entering upon any private property in carrying on its work, and of expropriating property, including water powers; but it may fairly be said that these powers are exercised with more than usual restraint, for though the commission has taken over 86 plants, up to the present no private water powers have been acquired except by negotiations. One case involved crown rights—that of a company operating in the central Ontario district, chiefly along the Trent Canal, but this purchase was made by the Ontario government direct and the works handed over to the Commission for operation. It was through this circumstance that the Commission came into the management of twenty-two private corporations, including not only electric plants, but gas works, water works, street railways, and a pulp mill. When these works were taken over the Commission found a great variation in rates, many individuals being favored with special terms at the expense of their neighbors. These discriminations were ended, the systems made uniform, the rates reduced from time to time, the capacity of the plants nearly doubled, and yet there has usually been a surplus in the yearly operations. No new water power of more than 150 horse-power may be developed in Ontario until plants and details have been submitted to and approved by the Commission.

At first the Commission bought all its supplies and had all repair work done outside, but as its operations grew it was found convenient to buy lamps and other equipment and supply the municipalities from this stock. For small repairs the Commission in 1912 equipped a small shop with a lathe and a drilling machine, and a testing bench was installed for testing lamps and meters. From this small beginning, a "Service Department" has developed, employing technical men and workmen to the number of 200. The service building contains laboratories for testing, inspection, and research. The testing equipment is probably the most complete in Canada, the lamp testing apparatus being capable of testing all voltages up to 220; and a new volt meter, using a principle not hitherto applied to such instruments, is able to measure voltages

up to 300,000. This service grew largely out of the circumstance that the voltage of 110,000 on the Niagara system was the highest in practice on the continent and many items there required were not then obtainable in Canada.

The requirements of the Commission have been of incidental advantage to manufacturers of electrical appliances who may have their output standardized by the tests here made. The "approval" testing includes all kinds of household appliances, such as toasters, laundry irons, cable, switches, etc., in fact anything which may cause a fire or accident. This feature leads to another phase of the Commission's work which has proved a public advantage. Before the Commission began, the inspection of electric wiring and equipment of buildings for insurance purposes was carried out only in Toronto and two or three other Ontario cities, and was a voluntary service undertaken by the insurance companies to lessen the fire risk. The only means of making it effective was by a rate which discriminated against uninspected premises. But this was not satisfactory, as companies who were not members of the insurance association or individuals who would not be insured at all could not be induced to live up to the standard of safe wiring. After a system of municipal inspection had been tried and had failed because of lack of uniformity in requirements, the Ontario government committed the whole business of inspecting buildings to the Commission, and then for the first time in the history of fire insurance inspection in Canada primary consideration was given to the saving of human life, the safety of property being of secondary importance. Uniform rules are carried out and the work formerly done by 200 inspectors is now more efficiently carried out by 54 inspectors.

In the early stages of the hydro-electric movement there were abundant indications that the private corporations which had dominated the public utilities of southwestern Ontario would use the courts and the legislature to obstruct and if possible defeat the movement for co-operative public ownership. The validity of the first agreements between the municipalities and the Commission was attacked, and acts had to be passed by the legislature specifically to validate these agreements. As a protection against

injunctions and other legal annoyances the hydro-electric act contains a clause providing that "without the consent of the Attorney General no action shall be brought against the Commission or against any member thereof for anything done or omitted in the exercise of his office," and neither the Commission nor the Province is held liable for any error in estimates or specifications of work furnished by the Commission. The protection against actions at law is the same as that afforded to Canadian universities; and although private interests have sought to make it appear that the provision was an afterthought designed to aid the Commission in processes of confiscation, the proviso in question was a part of the original hydro-electric act. Moreover, the acts creating the power commissions since established in the provinces of New Brunswick, Nova Scotia, and Manitoba all contain provisions of precisely the same character. It may be interesting here to note an important difference between the laws of the United States and Canada where there is a conflict between public policy and private property rights. By the constitution of the United States no property may be taken without compensation. In Canada this subject is largely within the jurisdiction of the provinces, and in Ontario by a recent act the private owner is entirely at the mercy of the province when public policy requires the revindication of lands, water powers or the like. In Nova Scotia an act respecting water and water courses was passed in 1919, in connection with the new power commission, in which it is declared that, notwithstanding any previous law, grant or deed, all water and water courses are henceforth "vested in the crown in the right of the province." Where any person, within two years of the passing of the act, establishes that he was lawfully using a water course he may be entitled to continue the use on terms deemed just by the Lieutenant Governor-in-Council (the administration). These acts do not mean confiscation in the sense of depriving a man of the results of his labor and materials put into a water-power plant, for example, but they do mean that the resources of nature which the private owner did not create, which had cost him nothing and which were there before the first white settler invaded the land, shall not become the sole right and inheritance of the individual

owning the land on the immediate site of the water power. Before the days of electricity, when water power was useless except at the mill-dam, the theory of ownership of the water might pass unchallenged, but in these days of electricity the river which owes its powers to the rains upon thousands of square miles of land beyond the control of the owner of the land at the waterfall owes an equity in electric current to the dwellers on those lands which makes the powers possible. In other words the theory of converting the powers of heaven and earth into a private right that can be capitalized as a perpetual franchise must be abandoned.

The relations of the individual municipalities to the Commission may now be considered. A municipality may have a water power within its own boundaries, or it may have to depend for its power upon connections with lines already established. In the former case it applies to the Commission for an estimate of the cost of acquiring or developing the power. The Commission undertakes this investigation at its own expense, but when the municipality takes up the operation the costs are transferred to it as part of its capital outlay. Where connection is made with established lines the Commission in the same way furnishes estimates of the cost of the local distribution system, and cost of connection with the main lines. If the municipal council is of opinion that the electors would desire to own and conduct their power and lighting services under the Commission, the first step is to prepare a by-law setting forth the costs and conditions, and a special vote is taken thereon. If the by-law is carried the next step is to submit another by-law to provide the money. A contract for power may then be made with the Commission. The money is raised by the municipality's bonds or debentures, maturing in 30 or 40 years; these debentures are deposited with the Commission, and are covered by the Commission's bonds deposited with the provincial treasurer, the province becoming in effect the guarantor. The price per horse-power payable by any participating municipality is based first on the cost to the Commission, figured as at the point of development or at the point of delivery, and the municipality pays its proportion of the following charges, as annually adjusted by the Commission: (1) interest at the rate of 4 per cent on the money expended by the

Commission in the construction or purchase of the works; (2) an annual sum sufficient to form a sinking fund to extinguish the debt in 30 or 40 years; and (3) the line losses, proportion of cost of operation, repairs, renewals, and the insurance of the works. The Commission may charge interest on arrears of payment, and may cut off the power in case of default and the municipality must take power exclusively from the Commission. These conditions may, on the face of things, seem exacting, but the terms are perfectly well known and are in fact set forth in the published contract beforehand, and the steady growth of the Commission's system shows that those who keep faith need not fear the outcome. Except where power is purchased from private companies for a limited term of years, there is generally no set term of the contract with the Commission, and the relation of the Commission and its constituents is that of a union from which no divorce is expected. The constituent municipalities may be those of a city, town, village, or rural municipality, known as a township. In cities of 100,000 or more the services under the Commission may be carried on by a local commission whose organization usually corresponds to the provincial Commission. Should there be a surplus on the operations of any municipal system the Commission may direct that it be applied, either to reduce the debt incurred for construction, or in maintenance, repairs or renewals; or otherwise to form a fund for contingencies or the cancellation of debenture debt.

The Commission has power to direct changes in the accounting systems of its constituents, and has proved of such help in the standardization of county and rural township accounts hitherto very irregularly conducted in many cases, that its forms are being applied to municipal accounts throughout the province. The Commission's engineers have been of assistance to the municipalities in giving helpful suggestions on water works, gas works, and sewage disposal works as related to power supply. The local rates for light and power must have the approval of the Commission, before whom, also, any complaints of discrimination or unfairness to individuals may come for adjudication. The penalty for non-compliance with the orders of the Commission is \$100 per day.

Where the assessed rate payers or freeholders of a section of a rural municipality desire the advantages of the Commission's power

system, and the remainder of the municipality may not be interested, the section so desiring the power may, upon the petition of a majority of the freeholders, apply for and receive power. Any petitioner has the right to withdraw his name within a month and if this withdrawal leaves the petition with a minority of the electors no further steps are taken; otherwise the action follows the usual course, except that the debentures are for 20 years and are covered by an annual rate on the property within the area described.

At an early stage of the Commission's progress the need was felt of an extension of the interurban systems of the electric railways in association with the extension of main power lines, and in 1913 an act called the Hydro-electric Railway Act was passed, authorizing the Commission to do in the electric railway field what it had done in electric power and lighting services. Owing to the amounts of money and power diverted by the war into the production of military equipment and munitions, construction of electric railway lines has been halted until now, although, under the local Hydro-electric Commission in London, Ontario, a steam line from that city to Port Stanley was taken over from the Pere Marquette Railway and electrified, and from a state of disrepute and dilapidation has been transformed into the best equipped and most prosperous suburban line in Canada. The electric lines connecting Walkerville, Windsor, Sandwich, and Amherstburg, along the Detroit River, have also, at the request of the towns concerned, been taken over by the Commission recently and have already been improved in efficiency. During the last three years the municipalities concerned have applied to the Commission to construct missing links and acquire steam and electric lines which would give the nucleus of a system of interurban electric railways extending from the Niagara River to Hamilton, Toronto, and through south-central Ontario and on eastward from Toronto. These lines, some of which had already been authorized by the government, would cost in all over \$50,000,000. During the last session of the provincial Parliament, the opposition objected to the large outlay involved, especially since the new Queenston-Chippawa works were likely to cost about \$40,000,000, or \$10,000,000 more than originally estimated. A commission of inquiry into the radial railway policy at large was demanded and was granted. The new government,

which is a coalition of the Farmer and Labor parties, granted the inquiry with hardly a show of reluctance, as there was a demand for a liberal expenditure on new automobile highways and many of the farmer members do not yet realize the function of the electric railway as an essential link between a highway system and the trunk lines of railway. The investigating commission is now sitting, but its report, the recommendations of which cannot be anticipated, will not be rendered for some months.

When the federation of cities and towns committed themselves to the municipal power policy there were predictions of mismanagement, of inefficiency, and especially of the financial disaster which would be due to the fact that operating profits were discarded. Naturally the affiliated private companies whose monopoly of Niagara power was threatened ridiculed the idea of carrying on public utilities solely for public service. A book by an "expert" was published and much propaganda literature circulated to prove that power could not be furnished at the prices estimated by the Commission's engineers, and that the financial calculations were so impractical as to be certain to involve the whole province and ruin its credit. The actual achievement of the municipalities will show whether or not these gloomy predictions have been justified.

Although only seven municipalities had committed themselves to the expenditures necessary for their local distribution systems, by the time the transmission lines were built and ready for initial operation the participating civic corporations had increased to fourteen. Meantime current was turned on for the pioneer seven in 1910, but out of the 12,000 horse-power allotted to these only one was able to take its full allotment at the start. The total power provided for the fourteen participants was 60,000, of which Toronto became responsible for 10,000 horse-power and received its first current in 1911. At the end of a year and a half the total power used by the city was about 6,000 horse-power, but in 1919 this had grown to 60,000 or an amount equal to the total allotment for the fourteen civic partners.

The Toronto Street Railway Company and the private lighting and power company had begun to receive power from their affiliated generating company at Niagara in 1906. These interests had

boasted that they could reduce their rates 20 per cent and still make a profit, and when the commission had come into the field with a rate of \$18.10 per horse-power delivered in Toronto the company authorized the statement that it was prepared to supply the city at \$8.75 and only ask payment for the power actually used. The offer came too late. The city had, before embarking upon the business, offered to buy out the lighting company, and was willing to give \$125 for its \$100 shares. The company would accept no less than \$160 per share and the city dropped negotiations. The company's stock was then above par; now it has been quoted at about \$44. In 1912 this company had 19,000 customers; in 1914 it had 22,000, but since then has ceased to publish its figures. The municipal system in its first year had less than 4,000 customers, and these have grown to 63,750 in 1919. Although by 1913 the city's investment in its distribution works totaled over \$5,000,000 there was a surplus of \$226,199 over operating expenses at the end of its first year, and a net surplus of \$13,555 after paying the sinking fund charges. In 1913 its surplus was equal to a dividend of $7\frac{1}{2}$ per cent on the cash invested.

When the Commission's systems came into the field the rates charged by private companies to industrial power users in Canadian cities varied from \$40 or \$50 up to over \$150 per year per horse-power, whereas the price charged to the Commission's local systems throughout the province averaged about \$22 per year. In case of Toronto the average rates to the citizens from the Commission's lines were \$20 per year. Before the era of "hydro" power the Toronto private lighting company charged 8 cents per kilowatt hour for residences; 8 cents, 10 cents, and 12 cents for commercial lighting and from $2\frac{2}{3}$ cents to 6 cents for power purposes. In 1914 the hydro system's average charges were 4 cents per kilowatt hour for residence uses, \$2.85 for commercial lighting, and \$1.31 for power purposes. The rates in Montreal in that same year under private company ownership ranged from \$30 to \$100 per year for power, and 6 cents to $7\frac{1}{2}$ cents per hour for residence uses. The Toronto Commission's rates were twice reduced, but in 1920 a slight increase (about 10 per cent) was made to cover the greatly increased cost of materials and labor. The private company at

first reduced its rates to compete with the municipal system; but has just increased its rates for the fifth time in the past four years. These increases were apparently designed first to choke off the small city-residence customers, and latterly the smaller commercial users, on whose business its profits were least. This policy it has been able to carry out because the power famine has prevented the local Hydro-electric Commission from adding to its customers for the past year and a half. There may be no relief to this situation, so far as Toronto is concerned, till October, 1921, when the new power plants at Niagara and other places will be ready for operation. The private company's reductions of the past are credited to the existence of the "hydro" system. What these reductions are cannot be stated in the absence of published statistics, but the savings brought about by the municipal system in the last eight years in Toronto alone are estimated at \$17,000,000; the saving in coal being calculated at 2,000,000 tons in the eight years.

The general results of the Toronto system's operation may be shown by the report, just issued, for the calendar year 1919. The total income was \$2,504,758.31; the cost of operation, management repairs, and maintenance \$1,577,122.50, leaving a surplus of \$927,635.81. If the enterprise had been conducted as a commercial corporation the net earnings would have been \$568,377, which would be equivalent to a dividend of 7 per cent on the capital actually invested. Out of these operations there is a total of reserves of \$3,062,865; made up of funds set aside for replacements, funds held by the provincial Commission to the credit of the Toronto system, sinking funds held by the city treasurer to relieve the debentures when maturing, funds for contingencies (including among other items a loss of nearly \$19,000 on American exchange). The rate charged to Toronto by the provincial Commission during the past year was \$16.70 per horse-power per year.

A proof of the successful challenge to comparison with private corporations, both on the point of efficiency and economy to the citizens, is afforded by the situation in Toronto as compared with Buffalo and Niagara Falls. Toronto pays the cost of transmission for a distance averaging 90 miles; Buffalo receives about one-third its power from Niagara Falls—a large part of it from the Canadian

plants—at a distance varying from 18 to 27 miles, while Niagara Falls has its power generated in part within its own city limits. For domestic use the rates in the latter city average about three times those of Toronto, and in Buffalo over twice. In the case of Buffalo the excess cost is not surprising, seeing that out of a total of 120,000 horse-power used in that city the private corporation, which controls the lighting and power business of both Niagara Falls and Buffalo, and the electric transportation systems, still generates 80,000 horse-power by steam.

The savings in Ontario effected in some other centers were greater than in Toronto—especially where power was raised by steam at a cost of from \$40 to \$60 per year for generation alone—but the case of Toronto will be a fair illustration.

That the Commission has gained the confidence of the municipalities and their citizens, both as to its engineering and financial operations, is plain from its continuous expansion. There are now 181 municipalities in actual operation under the Commission, while many others have applied for power which the Commission cannot supply until the new power plants now under construction are finished. If it were not for the present power famine the total number of the municipalities in the Commission's systems would be over 250; a development not to be wondered at, considering there has been no instance where a civic corporation has entered the circle of the Hydro Union and has not had the reward of lower rates than it paid before, whether the previous service was carried on by the municipality or by a private company.

The financial success of the Union may be illustrated by the record of twelve of the pioneer municipalities whose operations date back to 1912. In that year the combined power load of these was 16,615 horse-power, while in 1919 the maximum load was 90,799 horse-power. The total debt incurred by the twelve was \$13,360,822, but these obligations have been reduced to \$11,432,267, apart from surpluses and reserves of \$5,550,769 which have been set aside to retire the debentures. Eight of these twelve municipalities now have enough reserves to their credit to extinguish all their outstanding debts; and yet in the face of the increased costs of labor and supplies, affecting all classes of industries, reductions

of rates ranging from \$4 to \$9 a year have been made in this group.

Taking the whole operations into account the plant and fixed assets of the Commission and the united municipalities now amount to \$106,600,000. While making allowance for all liabilities, including advances from the provincial treasurer, there was already an unincumbered surplus of \$2,900,000 at the end of 1919.

Sir Adam Beck, having investigated electric power operations on farms in Europe, made a start as early as 1910 in equipping demonstration outfits to educate the farmers of Ontario. Electric power is now used on farms in many districts for all sorts of household work, and in out-of-house work for filling silos, threshing grain, grinding and chopping, milking cows, pumping water, sawing wood, loading and unloading wagons, etc. The progress in this field is noteworthy but sporadic, according to density of farm population and the co-operative spirit of the farmers. For example, while there are whole townships where no progress has been made, electric power from the hamlet of Brownsville extends to 58 farms, and from the village of Norwich there are 30 miles of hydro lines, serving over 130 farms. To obtain a more equitable distribution rural service has now been rearranged into eight classes, according to the purposes and amount of power used, and according to the extent of co-operation among groups of farmers. This branch of our subject is of interest to the student of economics. We can compare the results, where such utilities are carried on with the object of operating profits to the holders of the franchise, and where they are administered with the definite purpose of the utmost service without aiming at profits. In 1897, which was 13 years before the lines of the Commission were in actual working, the company referred to as transmitting power to the Hamilton district, carried its main lines through a region of the Niagara peninsula, which has long been known as "the garden of Canada." It is the most densely settled, the wealthiest and probably the most intelligent community of farmers in all Canada. How is it that a company so situated and boasting truthfully that it produces power more cheaply than any power company in the Dominion has done nothing to encourage, but has distinctly discouraged the use

of electricity on the farms? The reason is quite simple and is frankly admitted by the company—it prefers to sell power in large blocks for street railways, large factories and corporations, rather than to educate a multitude of individual farmers on the advantages of the new power. There is less trouble and more immediate profit in selling in large blocks. This is perfectly natural where dividends are the first and main purpose of the power business. But where social progress and the problem of the depopulation of rural Ontario are urgent questions, which is the better aim, the accumulation of dividends taken from the people in the form of indirect taxation, or the widest distribution of this beneficent resource for the advantage of the whole community? The problem was stated in a practical form by Sir Adam Beck in one of his addresses: “Farm labor is expensive and scarce and this makes farm life more burdensome. When labor is scarce and expensive anything that takes its place is a help to the farmers, and we must encourage the farmer, because agriculture takes the first place in Ontario.”

The power production is carried on in nine systems, all except the Niagara system being designed for areas north of Lake Ontario and Lake Superior. These will be rearranged into about twelve systems having connections which will enable one system to help out another in case of accident. Speaking of geographical area it is confidently held that the Hydro-electric Power Commission is still at the beginning, and not at the climax, of its public service in Ontario. The water powers of the whole Dominion, as roughly measured, are estimated at 18,000,000 to 20,000,000 horse-power, but as scores of rivers in the north are still unexplored and their water powers consequently unmeasured, large additions must be made to this total. Of the total measured powers about 6,000,000 horse-power are in Ontario and about the same total in Quebec, in which province all the development is now, and likely to remain, under private company ownership.

Neither Ontario nor Quebec has any coal mines, and their known sources of oil fuel are very limited. Consequently the development of water power is a more urgent public problem than in any part of America. If the hydraulic powers of these provinces were fully developed they would be equal to a dozen of the richest

coal mines of the continent, for, unlike coal, water power is perpetual. The rapidity of the advance in this direction is indicated by a special report of the Department of the Interior showing that in 1918 out of a total primary power of 2,107,743 horse-power in all Canada 1,806,618 horse-power, or nearly 86 per cent, was being generated by water, and Ontario by itself generates 95.7 per cent of its power from water. Of the 752 distribution systems in Canada 389 are municipally or publicly controlled and 363 under private ownership, the situation in this respect being the reverse of that in the United States. The Dominion at large already has 226 developed horse-power per 1,000 inhabitants, a ratio exceeding that of any country excepting Norway. A favoring providence has opened wide a door for vast future development in Ontario. From the termination of the prairie land of Manitoba eastward through Ontario and Quebec for a distance of 1,200 miles the Laurentian Mountains run, generally speaking, parallel to and half way between the Great Lakes and the St. Lawrence on the south, and the Hudson Bay basin on the north. This backbone of mountains is the father of a system of water-power streams unique in the hydrography of the world, and will of itself have a profound influence on a comparatively unknown region which comprises the "Great Clay Belt" of 20,000,000 acres, whose resources await development and whose raw materials can best be turned to account by electro-chemistry and electro-metallurgy attainable in practice only by hydro-electric power. There can be no reasonable doubt that the great advance already made in the province of Ontario has been the direct result of the educational work of the Hydro-electric Power Commission, which has been more or less the model for the power commissions created within the last three years in Manitoba, New Brunswick, and Nova Scotia. The Commission has in the last ten years sufficiently proved its statesmanship to be trusted with the wisest utilization of the great natural resources to be brought into public service by the water powers remaining to be harnessed in Ontario.

E. B. BIGGAR

TORONTO, ONTARIO